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Gallurgical Enrichment of Silvinite Mines and Technology of Potassium Ore Processing

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Annotation: The article discusses the issues of studying the processing of sylvinite ore, the development of effective technological systems for halurgical enrichment and the analysis of the main stages of processing sylvinite, identifying prospects for accelerating the processing of potash ore and developing recommendations.

Key words and phrases: sylvinite, ore, halurgical method, technological system, potash ores, solution, crystal, mechanical impact.

INTRODUCTION. The galurgical extraction of KCl from silvinite is a cyclic (periodic) process, in which the obtained KCl is crystallized and the NaCl-saturated solution is obtained by leaching (melting) KCl from the sylvinite (KCl NaCl). The technological scheme of this method consists of the following main stages:

crushing of sylvinite ore;

Alkali washing of silvinite with a returned solution to dissolve KCl;

separation of solid halite residues from the solution, washing it to reduce KCl loss in the waste;

Separation of solid waste saline and soil sludge from a boiling solution saturated with KCl and NaCl;

Washing the soil sludge in the opposite stream with boiling water to reduce KCl loss;

For the crystallization of KCl, the solution is cooled, while the heat of the boiling solution is used to heat the returned solution;

the KCl crystals are separated from the circulating solution and processed to reduce its viscosity;

Drying of KCl crystals; the returned solution is heated for use in the washing process;

waste disposal, ie disposal of halite waste and soil sludge;

granulation of KCl used as fertilizer [1].

The crushed silvinite comes from the 1-5 mm conveyor (Figure 2.2.3) to Figure 1 bunker 2 and is calibrated from the supplier 3 through a belt conveyor 4 using an automatic scale 5, and the ore is transferred to the auger solvent.

LITERATURE ANALYSIS AND METHODOLOGY. Reconstruction of sylvinite S.N.Aliferova, N.N.Teterina, V.Ya.Polyakovskiy, A.I.Kudryashov, A.I. Polikarpov, A.K. Vishnyakov were considered in the research. However, there is insufficient scientific analysis in the field to improve the flotation stage of sludge during silvinite processing.

DISCUSSION. KCl from silvinite is dissolved in a solvent containing 110… 130 g / dm3 KCl

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and 240 g / dm3 NaCl. The solvent solution heated from 14 to 105… 1150S is fed to the second solvent 7. The middle solution in the second solvent flows by itself to the first solvent 6. With the parallel movement of the solution and fresh silvinite, complete saturation of the solution with KCl and NaCl is achieved. 1.5… 2.5 atm to maintain the desired temperature. sharp steam is supplied under a pressure of 0.15… 0.24 MPa.

The combined scheme of melting is shown above. Silvinite passes through the first and second solvents and comes to a halite waste auger mixer 8, where the slag heated to 70ºC and the filter of the 9 plan filters are washed with groundwater sludge washing water in the opposite flow. This increases the KCl output and allows 1 part heat to be recuperated. In a screw mixer, the heated solution flows into the second solvent.

The waste discharged from the auger mixer to the bucket elevator contains a 12-17% rotating solution. Therefore, to reduce the loss of KCl, the waste is washed with hot water in a plank filter (60 kt of water per 1 ton of waste). The washed halite waste contains 5… 7% moisture and 2 g of KCl, which is removed from the shop by a system of conveyors and sent to the processing plant.

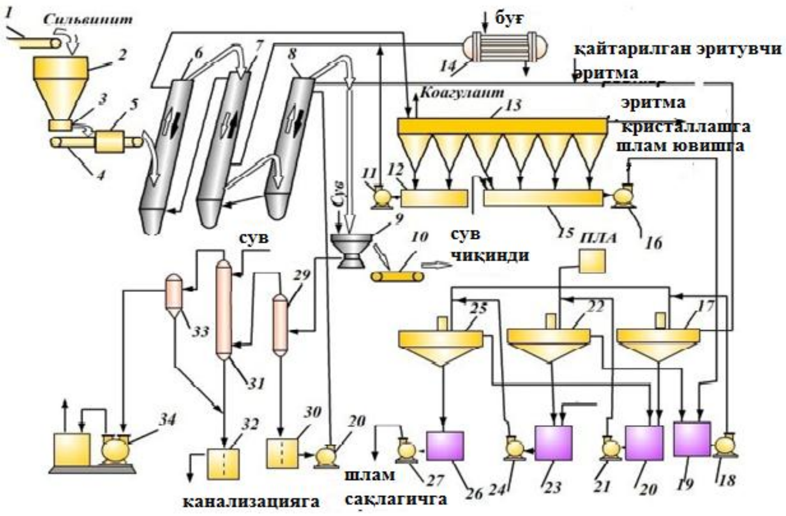

Figure 2.2.3. Scheme of obtaining potassium chloride from sylvinite by galurgical method. (Melting section, waste washing, sludge cleaning and settling).

1,4,10 belt conveyors, 2 bunkers, 3 feeders, 5 automatic scales, 6,7,8 screw mixers, 9 plan filters, 11,16,18,21,27,28 centrifugal pumps , 12-salt slag mixer, 13-sludge condenser, 14-tube heater, 15-sludge slag mixer, 17,22,25-sludge mixer, 19,20,23,26-recuperator, 31-mixing condenser, 33-holder, 34-vacuum pump.

The saturated solution obtained by melting silvinite consists of 245… 260 g / dm3 KCl, 215 g / dm3 NaCl, fine mineral particles, insoluble waste (gypsum, soil) NaCl crystals. During the galvanic processing of silvinite, an average of 20 kg of soil slag (65% of the ore content) with 160 kg of salt slag is removed from the Verkhnekamsky deposit with 1000 kg of ore. Salt particles and soil slag sizes vary by 88% particle mass sludge> 0.074 mm 84% soil particle size less than 0.05 mm. The variety of sizes makes them easy to distinguish. A 0.25% coagulant solution is added to accelerate the settling of the soil sludge [2].

Potassium chloride is obtained from silvinite ores by the following methods: KS1 is obtained by mechanical processing of raw materials or often (more than 80%) by flotation; based on the melting temperature coefficients of the salts in the ore, the salts are sequentially separated by melting and crystallization. This method is called thermal or galurgical (Latin - "salt work") or chemical method; sulphate rocks are also processed in the above methods; potassium salts are extracted from salt water by various methods. For example, Dead Sea saltwater is concentrated in evaporative basins. In this case, carnallite is extracted and processed to obtain potassium chloride [3].

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Other methods of enrichment. To do this, silvinite is ground and sludge, then a suspension of solids and solution is prepared, to which are added oil-insoluble petroleum products without fuel oil, paraffin or other soap, as well as reagents (aliphatic amines). The suspension is then transferred to a vibrating device and a product containing 79% KCl is obtained.

Enrichment by burning. When coarse-grained silvinite is heated, cracking of halite crystals is observed. Silvin crystals do not withstand heat. Enrichment is carried out in a rotary kiln at 400 ° C without mechanical action and at 450 ° C. Typically, the performance in a rotary kiln is lower than in heating silvinite without mechanical action. It is convenient to use mine furnaces for roasting. During the heating process, the wastes and clay mixtures in the top layer of silvinite are burned, as they can be suffocated during flotation enrichment. Therefore, burning silvinites is the best way to enrich.

Electrostatic enrichment. When two bodies rub against each other, they are electrified. In this case, small particles form a charge, at high voltages they can deviate from the right path to the electrostatic field. The method of electrostatic enrichment of silvinite is based on this. During the separation of silvin from halite, the initial thermal processing of silvinite enhances the charge and reduces the sludge effect. The charge sign of silvin and halite particles must be treated with reagents to form a charge of different value. They form a thin layer on the top layer [4]. To do this, it is recommended to use ammonia fatty amines, phthalic anhydride, phthalic and benzoic acids. As a result of such processing, silvin is positively charged, while halite is negatively charged at the same voltage [5].

The listed substances are recommended for processing silvinite before electrostatic enrichment.

organic sulfuric acid anhydrides and their mixed anhydrides; anionic substances and silicone oil;

ammonium hydroxide and slaked lime; 6 and more molecular organic substances of carbon atoms, and one or more SO4 Me or SO3 Me group compounds; high molecular weight organic acids, aliphatic and cycloalifatic and aromatic esters and their salts, other carboxyl sulfoxides.

The electrostatic enrichment method can be used when the amount of silvinite is high. Using multi-stage combined drum separators, this process is carried out in 2 stages.

Enrichment in heavy suspension. If the speed of movement is too high and the suspended particles do not settle, the suspension will have the property of a solid liquid. In this case, particles with a lower density than the suspension density rise to the top, while particles with a higher density fall to the bottom layer. The density of halite (NaCl) is 2.17 g / cm 3, that of silvin (KCl) is 1.98 g / cm 3. layer, and the halite collapses.

It is convenient to work with heavy liquids, but it is very difficult to get such cheap liquids. Therefore, in practice, saturated suspensions of NaCl and KCl in magnetite or ferrosilicon solution are used. The magnetite and ferrosilicate suspension do not stand still. The separation process can only be carried out on suspension-operated devices. Such a device can be a hydrocyclone, because in it under the influence of centrifugal force particles with a high density go to the walls of the device, the particles fall down in a spiral direction and are removed through the lower nozzle. At the same time, the small-density particles move upwards and are removed from the nozzle at the top. The concepts of ‘high’ and ‘low’ are relative here because the hydrocyclone can also be horizontal. The enrichment products fall into the shaker and are divided into two: salt and suspension, and then washed. The washed concentrate is transferred to the dryer. In the latter case, the product contains 95% KSl and 0.4% N2O. After washing, the suspension is discharged into the waste.

Ammonia method. In concentrated (80% and more) aqueous-ammonia solution and liquid anhydrous ammonia, KSl is practically insoluble, while the solubility of NaCl is much higher. Nabiev MN proposed to dissolve silvinite in a concentrated (80-90% NH3) water-ammonia solution. After melting the halite, after its separation into phases, KCl forms a precipitate consisting of water-insoluble substances, anhydrides. After ammonia is distilled and dried, 86-

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89% technical KCl is obtained. When the absorption rate of potassium ore is 97-98%, 99.8% NaCl is obtained after evaporation of ammonia from the solution.

CLEAR CONCLUSIONS AND PRACTICAL SUGGESTIONS. In conclusion, the consideration and analysis of various methods of processing based on the mineralogical composition of silvinite and insoluble residues The choice of galurgical method for the production of potassium chloride corresponds to the characteristics of potassium deposits in Central Asia and potassium ores of Uzbekistan.

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